

What is claimed is:

1. A cooling plate comprising a groove, which becomes a passage of a coolant, inside a body thereof, wherein the groove is covered with a lid with width larger than the groove, and the lid is joined to the body by friction stir welding, and a weld bead formed by the joining are outside the passage.

2. A cooling plate comprising grooves of a closed passage, which become a plurality of independent passages of a coolant, inside a body,

wherein the grooves are covered with lids, and the lids are joined to the body by the friction stir welding, and a weld bead formed by the joining are outside the passages.

3. A cooling plate comprising a groove, which becomes a passage of a coolant, inside a body, wherein the groove is covered with a lid, and the lid is joined to the body by the friction stir welding, and at least an end of a weld bead formed by the joining is formed in the body except a joining.

4. A cooling plate comprising a groove, which becomes a passage of a coolant, inside a body, wherein the groove is covered with a lid having width larger than the groove, and the lid is joined to the body by friction stir welding and fusion welding, and a weld bead formed by the joining is outside the passage.

5. A cooling plate comprising a groove, which

10024598.122101

Sub A

becomes a passage of a coolant, inside a body,

wherein one or more fins are provided inside the groove, and the groove is covered with a lid having width larger than the groove, and the lid is joined to the body by the friction stir welding, and a weld bead formed by the joining is outside the passage.

6. A cooling plate comprising a groove, which becomes a passage of a coolant, inside a body,

wherein the groove is covered with a lid, and the lid is joined to the body by friction stir welding, and the passage is a passage closed within the body.

7. A cooling plate comprising a groove, which becomes a passage of a coolant, inside a body,

wherein the groove is covered with a lid, and the lid is joined to the body by friction stir welding, and an air vent is provided in a portion forming the passage.

8. A cooling plate comprising a groove, which becomes a passage of a coolant, inside a body,

wherein the groove is covered with a lid, and the lid is joined to the body by the friction stir welding, and the lid is joined by friction stir welding owing to insertion of a rotation tool having a shoulder and a pin and at least an end of a weld bead of the joining is out of the joining.

9. A cooling plate comprising two or more U grooves per one meter wide, which become passages of a coolant, inside a body,

10024598-122101

Sub 21

wherein the grooves are covered with lids, and the lids are joined to the body by friction stir welding, and the passages are passages closed within the body.

10. A cooling plate comprising a longwise M-shaped groove, which becomes a passage of a coolant, inside a body that is a long plate,

wherein the groove is covered with a lid, and the lid is joined to the body by friction stir welding, and the passage is a passage closed within the body.

11. A sputtering target,

wherein a target material for sputtering is joined on the cooling plate according to claim 1.

12. A manufacturing method of a cooling plate that has a first groove, which becomes a passage of a coolant, and a second groove, which has width larger than the first groove and receives a lid on the first groove, inside a body, places the lid on the second groove, and is joined to the body,

wherein, while the lid and the body are joined together by friction stir welding owing to insertion of a rotation tool having a shoulder and a pin, joining is performed so that a weld bead formed by the joining may become outside the passage.

13. A manufacturing method of a cooling plate which has a groove, which becomes a passage of a coolant, inside a body, and in which a lid is joined to the groove,

10024598.123101

Sub A

wherein, while the lid and the body are joined by friction stir welding owing to insertion of a rotation tool which has a shoulder and a pin, the groove is made to be a left-hand side to a traveling direction of joining when the rotation tool rotates to the left, the groove is made to be a right-hand side to a traveling direction of joining when the rotation tool rotates to the right.

14. A manufacturing method of a cooling plate which has a groove, which becomes a passage of a coolant, inside a body, and in which a lid is joined to the groove,

wherein, while the lid and the body are joined by friction stir welding owing to insertion of a rotation tool which has a shoulder and a pin, a center of the rotation tool is set in a position which is apart from an edge of the groove by a radius of the pin or more.

15. A manufacturing method of a cooling plate which has a groove, which becomes a passage of a coolant, inside a body, and in which a lid is joined to the groove,

wherein, while the lid and the body are joined by friction stir welding owing to insertion of a rotation tool which has a shoulder and a pin, a joining direction where the rotation tool rotates is a direction opposite to a rotational direction of the rotation tool when the joining direction by the rotation tool

10024598.122101

passes a curve.

16. A manufacturing method of a cooling plate which has a groove, which becomes a passage of a coolant, inside a body, and in which a lid is joined to the groove,

wherein, while the lid and the body are joined by friction stir welding, joining becoming a folding of the joining is made to be joining by two straight lines.

17. A manufacturing method of a cooling plate which has a groove, which becomes a passage of a coolant, inside a body, and in which a lid is joined to the groove,

wherein a joining of the body and the lid has a projection thicker than other sections, and joining to the projection is performed by friction stir welding owing to insertion and movement of a rotation tool having a shoulder and a pin.

18. A manufacturing method of a cooling plate which has a groove, which becomes a passage of a coolant, inside a body, and in which a lid covers the groove,

wherein the lid is joined to the body by friction stir welding, and

while the lid and the body are joined by friction stir welding, an air vent is provided in a portion forming the passage.

19. A manufacturing method of a cooling plate

10024598.122101

Sub Q1

which has a groove, which becomes a passage of a coolant, inside a body, and in which a lid covers the groove,

wherein the lid is joined to the body by friction stir welding, and

while the lid and the body are joined by friction stir welding owing to insertion of a rotation tool which has a shoulder and a pin, at least an end portion of the joining is formed out of the joining.

20. The manufacturing method of a cooling plate according to any one of claims 12 to 19,

wherein, after the lid and the body are partially and temporarily joined by friction stir welding owing to insertion of a rotation tool which has only a shoulder beforehand, a whole joining is joined by friction stir welding.

21. The manufacturing method of a cooling plate according to claim 12,

wherein, after the lid and the body are partially and temporarily joined by fusion weld or friction stir welding beforehand, a whole joining is joined by friction stir welding.

22. The manufacturing method of a cooling plate according to claim 12,

wherein joining is performed in a coolant made of any one of water, oil, and an inert gas, or with forcibly cooling a joining and an inside of the rotation tool with the coolant.

10024598.122101

Sub 1

Sub 2

23. The manufacturing method of a cooling plate according to claim 12,

wherein a projection is provided in an insertion side of an joining of the body and the lid where the pin is inserted.

24. The manufacturing method of a cooling plate according to claim 12,

wherein a surface of a weld bead of the joining is concave by pressure of the shoulder.

25. A manufacturing method of a sputtering target that joins a target material for sputtering on a cooling plate,

wherein the cooling plate is manufactured by the manufacturing method according to claim 12.

10024598.122101

B3
B4